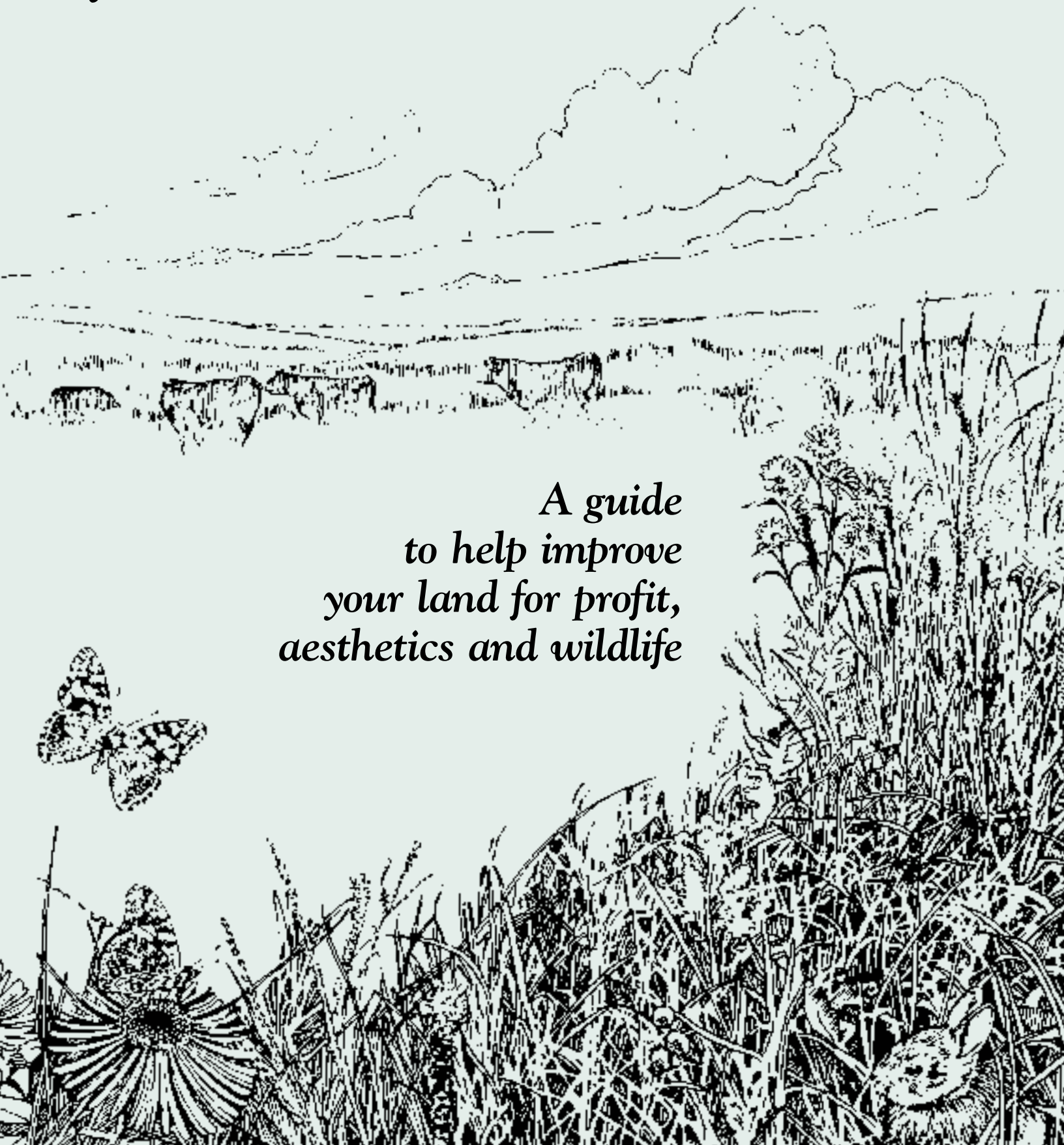


Rich Grasslands *for Missouri Landowners*

*A guide
to help improve
your land for profit,
aesthetics and wildlife*



Cover illustration by Diana Jayne

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Forb illustrations by Miriam Wysong Meyer

courtesy of the Illinois Department of Conservation, Division of Forestry

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*Thirteen-lined
ground squirrel*



Prairies Past and Present

In the early 1800s, native grasslands covered about one-third of Missouri, or 15 million acres. At that time, prairie grasses and wildflowers covered much of northern and southwestern Missouri, grew under the open pine forests of the Ozarks and edged the swampy land on sandy ridges in the southeast.

Today we have 17 million grass-covered acres—but they're not as diverse. While a native grassland might support more than 200 kinds of grasses and flowers, a grassy field today is often one non-native grass, such as tall fescue. Of our original prairie, only about 75,000 acres remain.

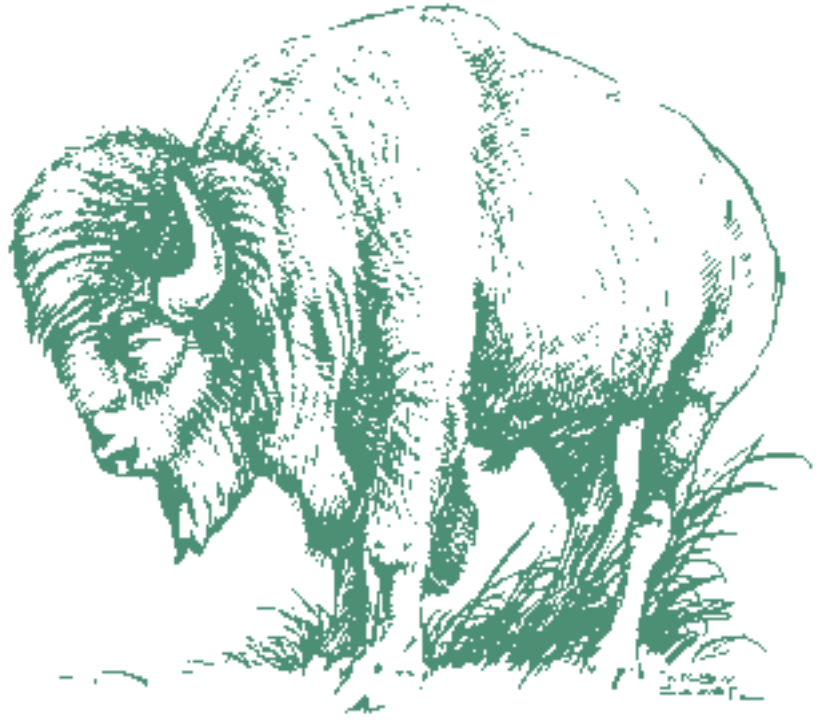
In the past, these native-grassland ecosystems supported an immensely rich mix of life. Ants, bees, grasshoppers, frogs, toads, skinks, snakes, voles, mice, rabbits, badgers, deer, bison and birds of all kinds depended on the clumpy warm-season grasses, legumes and wildflowers. Prairie streams provided habitat for fish, mussels and aquatic insects.

While many of the creatures that lived on these rich prairies still exist in Missouri, a few are extinct and many others are increasingly rare. Due to the changes in grasslands over the last century, birds that depend on these habitats are declining.

Because most of the land in Missouri is in private hands, the only way wildlife habitat will be improved is acre by acre and owner by owner. So whether you own a few acres or a few thousand, the future of wildlife in Missouri depends on you.

Different landowners have different goals. You might want income from the land, an attractive landscape, erosion control or better wildlife habitat. Or perhaps you want a mix of all of these. Whether you're farming or just enjoying the country life, it makes sense—and dollars, too—to diversify your grasslands.

The following two ideas are the keys to good grassland management. If you keep them in mind as you make your plans, you will enhance



Bison are just one of the many species that once thrived on Missouri's native warm-season grasses.

your property for yourself and for wildlife.

1. Diversity is good.

A field of one type of grass that grows to one height at one time of the year and is cut, burned or left idle all at once is like a desert when it comes to wildlife. It might support a few species for part of the year, but it's not going to support many for the long term.

2. Native plants make sense.

You may have many hardy non-native plants on your land that you value for one reason or another. However, if you want to add diversity to your land, you will need to cultivate native species that grow well in Missouri's climate and support a variety of wildlife. In addition, native warm-season grasses can provide excellent forage for livestock during the summer months when cool-season grasses are dormant.

What's in your Grassland?

Before you can improve your grasslands, you need to know what is growing there. Is it a field of basically one cool-season grass? Are there a few prairie plants such as little bluestem or butterfly weed? Is it a remnant prairie that's never been plowed? Plant identification books can help you determine what is growing on your land. See page 34. For further help, contact the Missouri Department of Conservation private land conservationist in your area. See page 35.

Types of grasses

There are two basic kinds of grasses:

- ✓ cool-season grasses that grow best in spring and fall
- ✓ warm-season grasses that grow in the summer heat.

Historically, Missouri prairies were mainly warm-season grasses such as big bluestem, little bluestem, sideoats grama and Indian grass. When they're managed properly, native grass roots grow 5 to 15 feet deep and increase the soil's organic fertility with a complete regeneration of the root system every three or four years.

This increased fertility does not take place with the shallower rooted cool-season grasses that were brought here from Europe or Asia. Orchardgrass and Kentucky bluegrass are two species that were introduced by early colonists. Tall fescue and smooth brome grass arrived in the 1880s. Canada and Virginia wild rye, on the other hand, are cool-season grasses native to North America.

Tall fescue

Since the 1950s, tall fescue has been widely planted in Missouri because it can be closely grazed, stockpiled for winter grazing and used for erosion control. This non-native grass is not useful, however, as summer pasture or as a grassland that supports a variety of life.

Imagine a forest so dense that there's no room to walk between the trees. Fescue forms a sod so solid that songbirds, quail and rabbits have a tough time walking about in search of food or bare soil for dust baths. Young quail, attempting to keep up with their mother foraging for high-energy insects, can become exhausted and die. Haying or heavy grazing only makes tall fescue more uniform in height, which creates a denser sod and eliminates overhead protection for most of the year. Light grazing that leaves some of the fescue untouched, but creates paths and edges, is probably the best way to manage tall fescue for wildlife.

Tall fescue also can give off toxins that either kill or inhibit the growth of other plants nearby. The plants you don't find growing in tall fescue sods are often critically important foods for insects and wildlife. It's not a friendly neighbor, which is

Exotic invaders harm prairie diversity

Keep a lookout for exotic species that could take over at the expense of native plants. Attacking the invaders early makes them much easier to control, but it may take several years of repeated effort no matter how soon you start.

Burning, hand weeding, cutting and applying herbicides are all part of the arsenal. Some species can be controlled with burning alone, others may require cutting and spot spraying of herbicides. If you create bare soil, you'll need to be especially watchful for these non-native invaders: autumn olive, sericea lespedeza, tall fescue, Caucasian bluestem, reed canary grass, musk thistle, Johnson grass, cut-leaved and common teasel, purple loosestrife and multi-flora rose.

For more information, see page 22 or visit the Conservation Department's web pages at: www.mdc.mo.gov

why small shrubs or trees planted in fescue tend to grow slowly or die.

Another problem with tall fescue is that it sometimes carries a fungus that causes disease in cattle that graze on the grass, particularly in the summer. The fungus also can affect wildlife such as burrowing mammals and insects.

So why keep a field in fescue? Its toughness and ability to grow on just about any soil are two reasons. It's also difficult to get rid of once it's established. But good diversity—either within a field or among fields—means less fescue overall.

Forbs

Often called flowers or weeds, a forb is any non-woody plant other than grasses, rushes or sedges. Although grasses are the main plants in prairie by volume, they're outnumbered by forbs in variety.

Butterflies, birds, moths, bees and mammals all use forbs along with grasses for food or shelter. The more variety you create, the more life you support. Examples of forbs include compass plant, pale purple coneflower and rosinweed.

Legumes

Forbs in the pea family, called legumes, include non-native plants such as red or alsike clover and annual lespedeza, as well as the natives such as prairie clovers, bundleflower, sensitive brier and slender lespedeza. They help make nitrogen available in the soil for other plants to use, while the leaves and seeds provide nutritious food for many species—from cattle to quail.

While more expensive to plant than grasses, forbs such as the ones shown here add color, as well as additional food and shelter for wildlife.



Shooting star



Blue hearts



Wild hyacinth



Whorled milkweed

Prescription for Healthy Grasses

This booklet contains a set of prescriptions to help improve the health of your land and the life that depends on it. There's not one simple rule—many factors are involved. You can learn the general practices for improving grasslands, but keep in mind that weather, economics and what you have to begin with all play a part in what you can achieve and how long it takes to get there.

First, do no harm

Before you rush into any plan, check to see what you already have so you don't accidentally destroy thriving native grasses. Although it's rare to find a field in Missouri that's never been plowed, you might be one of the lucky ones. Or you may have a pasture that was plowed years ago, but was reinvaded by some prairie plants after cropping eased. In either case, you may only need to do a combination of prescribed burns, tree cutting and possibly some spraying of the proper herbicide at the right times to kill the non-native plants and favor the natives.

Pawnee Prairie in northwest Missouri is one example of remnant prairie land. Acquired in 1996 by the Conservation Department, the area had been heavily grazed, but much of it had never been plowed. Fescue and weedy plants had invaded, but with careful management, native prairie plants are starting to dominate once again.

Check for existing native plants

Below are some ways to determine if native plants are present in an old field or fescue sod. Depending on the condition of your field, one or more of the following methods can be used. A Department private land conservationist can help you determine which combination you should try on your land. See page 35.

- ✓ If plant matter provides enough fuel, conduct a spring burn to knock back the woody plants. A

second or third spring burn may be necessary, followed by a fall burn.

- ✓ Graze intensively in April and May, then remove the cattle.
- ✓ Spray in the fall or spring with herbicides such as Roundup, Touchdown or Select to kill tall fescue and other introduced cool-season grasses. For rates, follow the directions on the herbicide label or consult a fescue conversion guide, which is available from the Conservation Department. See page 33.
- ✓ Mow close in April and again in late May or early June.

After using one or more of the methods above, examine your field in June through September for native prairie plants. If you have few or no native plants, the following chapters will tell you how to increase the diversity in your field.



Switch grass

Seeding for Diversity

If you don't find any native plants after following the steps in the previous chapter, it's time to begin a seeding plan based on one or more of the following goals:

- ✓ Income through seed production of either grasses or forbs, which require single types of seed in selected plots.
- ✓ Pasture, which requires a mix of native warm-season grasses and legumes.
- ✓ Wildlife habitat and an attractive landscape, which requires a mix of native grass and forb seeds. The more forbs you plant, the more aesthetically pleasing—and expensive—the project becomes.

Location

Because fire is an essential tool to develop native grasslands, it is important to consider a location where the field can be burned safely. A field bordered by firebreaks such as roads will save you the effort of creating barriers later with a plow, disk or by mowing.

If your property is in a populated area, check to see if the native plants you want to grow and the field you want to develop are not in violation of local weed ordinances. A planting of native plants looks much different than a manicured lawn and may not comply with community regulations.

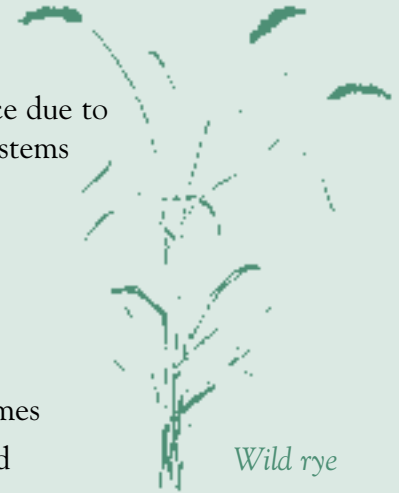
Soil

Although prairie plants can be found throughout the state, certain species thrive only in particular types of soil. Missouri soils vary from wet to dry, acidic to alkaline, sandy to heavy clay. Because the heavy clay soil in north Missouri won't support the same mix of plants as a shallow, rocky soil in the southwest part of the state, you need to know the composition of the soil before you can decide what to plant.

To analyze your soil type, dig a small hole in the field. Grab a handful of the exposed soil and squeeze it to determine the texture. See below.

Why Plant Native Grasses

- Low maintenance
- Drought tolerance due to extensive root systems
- Increased livestock gains
- Improved wildlife habitat
- Quality hay at convenient times
- Income from seed



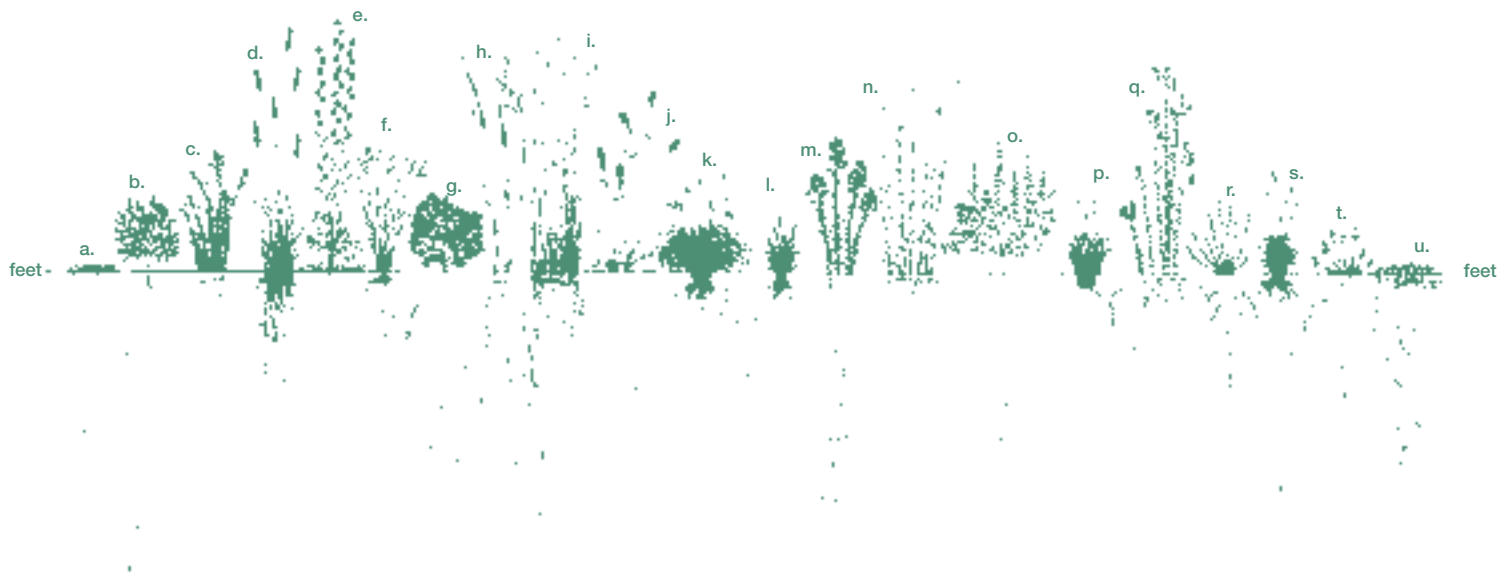
- ✓ Clay soils are made up of very fine, plate-like particles that tend to stick to each other.
- ✓ Silt is made up of fine particles that stick to your hand when wet.
- ✓ Sand is comprised of larger particles that don't stick together.

Clay soils usually hold minerals better than sandy or silty soils, but too much clay can mean too little oxygen will be available to the plants' roots.

The quality of the soil is affected by the quantity of plant material growing in it. Because their roots grow deep, prairie plants formed the rich soil that made the United States an agricultural giant. Some species' roots reach 15 feet into the ground. Having organic material in the soil helps to enrich it, hold moisture and make it easier for plants to grow.

Knowing the acidity of your soil also is important. A neutral soil has a pH between 6 and 7.5—the range in which the most nutrients are available to plants in general, and the range at which most prairie plants grow well. A typical hardwood forest has a more acidic pH of 4 to 5, while a limestone outcrop has a pH of 7 to 8. If your soil is too acidic, add lime to make it more neutral. Although seldom necessary in Missouri, adding organic material can increase acidity if needed.

Root Systems of Prairie Plants



Note how the root system of the cool-season (a) Kentucky blue grass is much shallower than the native prairie grasses and plants. This shallow root system forces non-native cool-season grasses to do most of their growing in the early spring and late fall when moisture is near the soil's surface. The deeper roots of the following native plants allows them to have a longer growing season: (b) lead plant, (c) Missouri goldenrod, (d) Indian grass, (e) compass plant, (f) porcupine grass, (g) health aster, (h) prairie cordgrass, (i) big bluestem, (j) pale purple coneflower, (k) prairie dropseed, (l) sideoats grama, (m) false boneset, (n) switch grass, (o) white wild indigo, (p) little bluestem, (q) rosinweed, (r) purple prairie clover, (s) June grass, (t) cylindric blazing star, (u) buffalo grass. Illustration by Heidi Natura, courtesy of the Conservation Research Institute.

For further help, contact:

- ✓ your county Natural Resources Conservation Service's office for a map and description of your soil. See page 33.
- ✓ University Outreach and Extension office to have a soil sample analyzed for a small fee. See page 33.

Seed mix for pasture, hay and seed production

Many landowners are rediscovering the value of native warm-season grasses for grazing, particularly in rotational systems. Wildlife, as well as livestock, can benefit.

When the soil reaches about 60 degrees F in the spring, warm-season grasses begin growing. They grow best in the warmest months of the year when the soil is about 90 degrees F. Although warm-season grasses have a shorter growing season, they make more efficient use of water and soil nutrients—nitrogen, phosphorus and potassium—than do other grasses.

Native grasses don't need fertilizer, herbicides or pesticides to maintain a stand. They will, however, respond to fertilizers with increased production and improved forage quality. To avoid helping cool-season grasses at the expense of warm-season grasses, apply the fertilizer when the warm-season grasses are growing vigorously and the cool-season grasses are beginning to go dormant.

A typical warm-season pasture is a mix of big bluestem, Indian grass, little bluestem, sideoats grama and eastern gama grass. Native legumes such as bundleflower, prairie clover, lead plant, partridge pea, slender lespedeza and roundhead lespedeza also can be part of the initial planting. By adding a few legumes to a native-grass stand, you can increase hay production by 15 to 20 percent. Legumes also may improve the forage quality and boost the protein level of the grasses.

Most introduced legumes, such as red and white clover and birdsfoot trefoil, are not compatible with native warm-season grass because they begin growth too early and reduce grass production. Alfalfa and annual lespedeza, however, are more compatible. Alfalfa may be seeded with the grasses at 3 pounds per acre.

Annual lespedeza, such as Korean, Kobe or Marion, should not be planted at the same time as the native-grass seed, but up to 5 pounds per acre may be added prior to the third or fourth growing season. Broadcast or drill annual lespedeza in February, if you are not burning in the spring. If a burn is planned, plant after the burn.

Native grasses and forbs normally are grown for seed in plots of single species varying from a few square feet to several acres. Planting a single

species of little bluestem, for example, allows the seed to be mechanically harvested at one time. It also makes it easier to clean and market the seeds.

Fields of mixtures of grasses and forbs have to be hand harvested or carefully stripped mechanically several times during the year. The seed mix may be more difficult to sell if demand is low or supply is high for some components.

While the demand of native grasses and forbs generally exceeds the supply and is projected to increase, don't assume a ready market is available. Most large seed vendors maintain their own production and only buy the few seeds they weren't able to produce themselves. Be sure to check the market before you make a significant investment in native-seed production.

Seed mix for prairie fields

Though it's not possible to fully recreate a prairie in one lifetime—with its host of microbes, plants and wildlife—you can certainly get it started. The reward will be a variety of birds, butterflies, insects and mammals that can find essential food and cover in the sea of grasses and flowers you planted.

Grass is the main structure in a prairie planting. If you want to see more wildflowers, avoid the very tall grasses like big bluestem, Indian grass, switch grass and eastern gama grass. Instead use the shorter little bluestem, sideoats grama and prairie dropseed. Avoiding switch grass altogether is a good idea because even the native variety is aggressive in mixed plantings.

Planting taller grasses with taller forbs in the center and medium-height native grasses with shorter forbs along the edge provides an attractive way of viewing wildflowers. By planting forbs only along the edge, you can save money because forbs are more expensive to plant than grasses.

The forbs you choose should include legumes to help the natural balance of nitrogen in the soil. Prairie clover, sensitive brier, bush clover, and tick

trefoil are all good choices that will add diversity, as well as nitrogen, to the grassland.

A good balance of flowers and grasses is essential if your planting is going to stay diverse and be affordable. As you choose a mix of seeds, plan on forbs to be 30 to 50 percent of the total mix by weight. More grass seeds will make them dominant, but too many forbs will provide too little structure for effective burning.

As you plan your forbs, consider:

- ✓ whether the plant is a later successional plant that appears only as the prairie mix matures. If so, you may want to add it later in spot plantings
- ✓ whether the plant is aggressive and would take over in certain locations
- ✓ when it blooms and what the height of surrounding grasses would be at the time.

By establishing the more aggressive species first—such as grey-headed coneflower, monarda, gayfeather, rosinweed, compass plant, ashly sunflower, rigid goldenrod and black-eyed Susan—you can let them compete with exotic weeds and save the less competitive, later succession plants—such as lead plant, prairie goldenrod, prairie clover, and azure aster—for later spot planting.

If you want to add ashly sunflower in plots of less than an acre, consider adding a couple of plants instead of seeds to keep this more aggressive plant from being too dominant.

Seed sources

The source of seed is an important consideration. For plants that are well adapted to your area and site, look for seed from native Missouri plants rather than from varieties that grow best in other states. Although seed from distant growers initially might be cheaper, in the long run it's less likely to survive and thrive. A number of nurseries carry seeds for native Missouri prairie plants. See page 33.

Developed native-grass cultivars may be used for forage production plantings, but they should be avoided for prairie restorations where grazing

and haying are not part of the management plan. Livestock keep the cultivars from dominating the stand, and the cultivars increase production and stand uniformity, which is desirable for grazing. Also, greater seedling vigor, uniformity and grass density created by using cultivars can help control erosion.

Do-it-yourself seed collecting, cleaning, sorting and storage can be a way to find seed that is known to grow in your area, but it requires knowledge of the best harvest time for each species, as well as permission to collect seeds on someone else's property.

The following books can help you learn the proper techniques of seed collecting:

- ✓ *Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands* edited by Stephen Packard and Cornelia F. Mutel



Sampson's snakeroot

- ✓ *The Prairie Garden* by J. Robert Smith with Beatrice S. Smith
- ✓ *Restoring the Tallgrass Prairie* by Shirley Shirley.

Seeding Rates

Seeding rate will depend on the following:

- ✓ your goals
- ✓ the species you plant
- ✓ the type of soil. *For example, clay soils produce more weeds, so you need to give them competition by planting more seeds.*
- ✓ the seeding method. *For example if you broadcast seed, you'll need 25 percent more seed per acre than if you drill it.*

Pure Live Seed, or PLS, is an important measure to know before you purchase your seed. Most warm-season grass seeds are fluffy seeds rather than simply a clear hard nugget of a seed. When you figure how much seed to buy and spread, you need to know how much of what you're spreading is actually seed, as well as how much of that seed is going to germinate. PLS is, therefore, the percentage of pure seed, excluding the fluff and stems, times the percentage of likely germination. The PLS rate is usually listed on the seed tag or invoice.

When you purchase your seeds, be sure you're getting the right amount of PLS. For example, suppose you want to spread a mix of little bluestem and sideoats grama on 4 acres, and you expect to plant at the rate of 8 pounds of grass per acre. You need 16 total pounds PLS of little bluestem (4 acres x 8 pounds/2 types of grass).

If you buy a 20 pound bag of little bluestem with a purity of 90 percent and a germination rate of 75 percent, then you have PLS of $20 \times .90 \times .75 = 13.5$, which is under your goal by 2.5 pounds. In this case, you would need to buy more seed.

In general, seeding rates for prairie grass plantings alone are typically 6 to 8 pounds PLS per acre. If you have a mix of grasses and forbs with 15 to 40 different total species, you might plant 3 to

4 pounds PLS of warm-season grass and 4 pounds PLS of forbs.

If you're planting a mix of several forbs, seed dealers can help you figure the relative amounts you'll need because the seeds vary greatly in size, weight and coverage.

When to Plant

Because native warm-season grasses grow during the summer months, plant them in spring for best results. Initial experiments with October through December plantings have been successful when the soil has cooled to the point that germination doesn't occur until spring; however, more testing is needed. If you plant grasses in winter, increase the seeding rate 25 to 50 percent to compensate for rot and rodents. Many forbs, however, need temperatures to drop below freezing before they will germinate, so they usually do better in winter plantings.

For forage production or erosion-control plantings in which forbs are less important, plant the grasses and selected forbs from March through June. Certain herbicides that accelerate grass establishment may be beneficial in speeding up the establishment of the grasses. Check with a Department private land conservationist for more information. See page 35.

Planting in late fall or winter is especially recommended for broadcast planting because it allows the winter's natural freezing and thawing to help mix the seeds into the soil.

Broadcasting in the spring, however, reduces the risk of wildlife eating the seeds or of them being washed away before they germinate. It also gives you a chance to prepare the seedbed and spray for weeds effectively just before planting.

Don't be disappointed if you don't see good growth for a couple of years after planting. Some prairie seeds won't germinate right away, and others will spend the first years putting energy into the roots rather than the leaves or flowers.

Preparing the Site

To prepare a field for planting you'll need to first do the following:

- ✓ provide weed control
- ✓ bare the soil to ensure good seed contact
- ✓ create a firm seedbed.

Undesirable vegetation should be killed before you plant, and you should know the field's herbicide history to be sure the seeds will germinate.

If you want to plant a crop field that was sprayed with Atrazine or Treflan, you'll have to wait two to four years before you can plant warm-season grasses and forbs. Warm-season grasses also are intolerant of crop herbicides containing imazaquin, such as Scepter, Steel, Squadron and Triscept. Wait at least 11 to 15 months after application before

planting to be sure residuals are no longer in the field.

Based on your soil test, you may need to apply phosphorus, potassium and lime prior to seeding. For best results, lime should be spread at least six months before seeding. A pH of 5.5 to 7.5 is acceptable for most prairie plantings.

Do not apply nitrogen the year you plant, which will encourage the growth of non-native cool-season plants. Because prairie plants evolved with small amounts of nitrogen supplied by legumes and the decay of microorganisms, nitrogen is more effectively supplied by adding native legumes to your plantings. If you can't find a fertilizer without nitrogen, a low rate such as 8-16-8 usually won't cause serious competition problems.

Native grasses and forbs can be planted into tilled seedbeds, crop stubble or killed sods. The method used depends on the amount of work you are willing to do to prepare the field and the type of vegetation that was growing on it previously.

Clean-till

Clean-tilled seedbeds should be fine textured and firm, preferably rolled with a culti-packer and on slopes less than 5 percent. Disk in the spring to a depth of 1 to 2 inches. Wait three weeks and disk lightly again to allow some of the weeds to sprout. Disk again to kill the newly sprouted weeds. Depending on the extent and type of weeds, you may need to spray a herbicide.

Harrow after the final disking, then firm the seedbed with a corrugated roller or culti-packer so when you step on the ground you can still see the sole of your shoe. If a roller isn't available, harrow two or three times, firm the seedbed and remember the shoe print rule. If you are planning to broadcast seeds, pack the soil before and after planting. Never pack or harrow a loose seedbed after planting because the seed will be pushed too deep.



Big bluestem



Prairie chickens

No-till in crop stubble

Seed may be planted into corn, milo or soybean stubble left standing from the previous year. This provides better erosion control on highly erosive ground, but the field may retain the roughness of the crop rows making future mowing and haying more difficult.

On erosive soils, a cover crop of oats may be planted in the fall and the native warm-season grass seed drilled or broadcast into the standing residue during the winter or spring. Planting into green wheat in late winter or early spring has been successful, but be sure that the variety of wheat you use won't inhibit the native-seed germination. Harvest the wheat for hay, rotary mow after the boot stage or cut for grain.

Perennial ryegrass may be planted with the native seed to provide cover while the grasses and forbs are getting established. Another cover choice is Canada wild rye, a native cool-season grass that tends to decline over the years as the slower-developing warm-season grasses take hold.

No-till sod

If you're converting from fescue or another cool-season grass, you should burn the field or mow low in late July or August. Then let it regrow to a height of 8 inches and spray it with one of

the following herbicides: glyphosate, which is found in Round-Up; sulfosate, which is found in Touchdown; or imazapic, which is found in Plateau. Apply the herbicide at least two weeks before the first frost so the herbicide has time to be taken up by the plants before they become dormant. If you see a lot of regrowth or many new seedlings in the spring, spray again before planting.

If your soil is reasonably bare after spraying, you can plant without disking. Light disking presents a trade off between having improved seed-to-soil contact and bringing up undesirable seeds that will compete with your planting. If the cool-season grasses and other exotic plants are under control and your soil is mostly bare, avoid disking. If a lot of dead plant material is on top of the soil, burn before seeding.

When broadcasting seed instead of drilling, kill the grass in the fall, then seed in early winter. Broadcasting at this time of year lessens the need for ground disturbance by taking advantage of the freezing and thawing action to help get the seed into the soil. In spring before the warm-season grasses begin to grow, spray any remaining cool-season grasses that are 6 to 8 inches tall using Poast or some other herbicide that's specific to grasses and won't harm germinating forbs. The dead cool-season grass will serve as mulch for emerging prairie plants.

Seeding Methods

Due to the variety of seed sizes and textures of native warm-season grasses and forbs, the appropriate planting technique is important. Drilling is the best way to plant native-grass seeds, if you have access to the appropriate drill. Switch grass and eastern gama grass both can be drilled with common agricultural equipment because switch grass flows through a standard legume box and eastern gama grass through a standard grain box. Most of the other native warm-season grasses, however, produce fluffy seeds that require a special native grass drill such as the Truax, Tye, Nesbit or the Great Plains rangeland drills. Check with the local Soil and Water Conservation District or the Conservation Department office to see if one is available to rent. See page 33.

Because most forb seeds are small and expensive, it is usually easier and more effective to broadcast them over the soil's surface. If a drill is used, the seed should be dropped with the tubes detached from the fine seed box of a Truax-type drill. If broadcasting, sow the small forb seeds separately from the larger seeds.

Native seeds establish best when the bed is firmed before and after seeding. Packing after planting is especially important when the broadcasting method has been used.

Drilling tips

- ✓ One advantage of drills over broadcast techniques is that they make good soil contact for larger seeds, and they can be set to distribute a small amount of valuable forb seed over the entire planting area. Planters such as Truax drills can also handle relatively trashy seed material up to an inch in size, so the seed needn't be highly cleaned.
- ✓ Drills do best when the seed box is kept fairly full and refilled when it's 1/4 full.
- ✓ The ground speed of the tractor is best at about 3 miles per hour.
- ✓ Check the seed tubes often to be sure they aren't plugged, especially when sowing fluffy, chaffy seeds. Use a wire to unplug the tubes at regular intervals.



*Drilling is the best way to plant native-grass seeds, if you have access to the appropriate equipment.
Illustration by Diana Jayne.*

- ✓ Large and fluffy seeds, especially warm-season grass seed, establish best when buried less than 2 times the size of the seed.
- ✓ Debearding grass seed improves handling quality, but increases the cost and still may require you to use a carrier to keep the seed from plugging the tubes. Keep in mind that fluffy seed won't flow through a conventional drill and debearded seed will flow too fast through a native grass drill, so find the right drill before ordering your seed.

Broadcasting tips

- ✓ If you broadcast seed, especially by hand, you should increase your seeding rate by 25 percent.
- ✓ Hot, dry weather or low soil moisture will reduce the success of broadcast seeding.
- ✓ Mix the seed with vermiculite, perlite, sand or another clean carrier to help disburse it evenly. The carrier also lets you see where you've already sown seed. For better coverage, spread half the seed in one direction and the other half at right angles to it, so the same ground is crossed twice.
- ✓ When hand seeding, estimate one person covering four acres in a few hours. To be sure

you get a good spread of seed and don't overseed, do the following test before you start. On a light-colored sheet on the ground, spread a 1/2 cup of mixed seed with the carrier material. It should cover roughly a 5 x 5 foot area.

- ✓ Air spreaders normally require debearded seed and 70 to 100 pounds per acre of phosphorus and potash or pelleted lime as a carrier.
- ✓ Cyclone fertilizer spreaders may use either chaffy or debearded seed, but are more efficient with debearded seed. Use 120 pounds of phosphorus and potash fertilizer to aid spreading and prevent lodging in the hopper. Apply the mixture in two trips—first using a normal fertilizer spacing pattern and splitting the spacing on the second trip. This pattern is preferable to the right-angle pattern described for hand seeding because it can leave a checker-board pattern with unsown areas.
- ✓ If the seed is spread in the late fall or winter, the freezing and thawing action will help work it into the ground. If the ground isn't frozen, roll with a corrugated roller or culti-packer when you're finished seeding. Do not disk or harrow to cover the seed in any season.

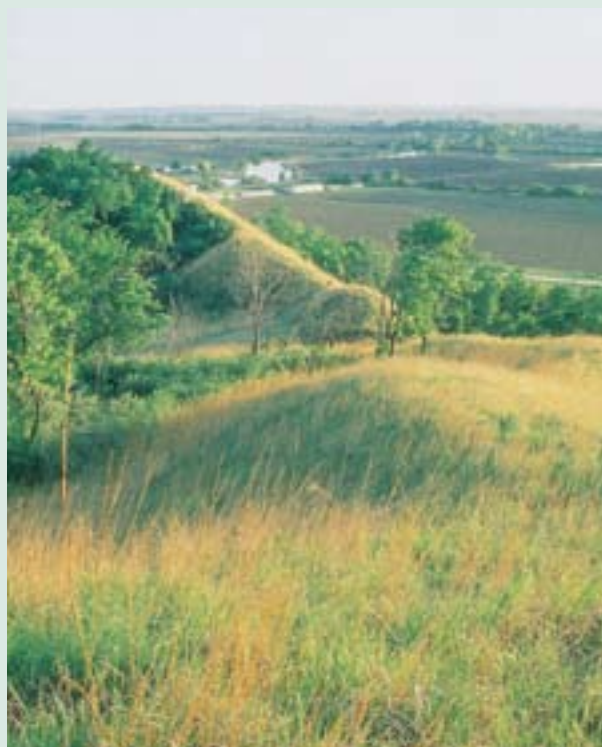
Selecting Native Plants Based on Soil Type



Above, left, pale purple coneflowers thrive in the dry to medium soil at La Petite Gemme Prairie. Cordgrass and sweet coneflowers are common in Missouri's wet prairies, such as Helton Prairie shown above right. Below, left, the Star School Hill Prairie Natural Area is an example of a dry loess hill prairie. Loess is ancient, wind-blown soil. La Petite Gemme photo by Pat Whalen. Photos of Helton and Star School Hill prairies by Jim Rathert.

The mixes of plants on the following pages are suggestions based on their typical success in a range from dry, shallow to moist, deep soils. Some that do well in the first group also will do well in the second, but those that thrive in deep, moist soils, for instance, won't do well at the other extreme.

If grazing is part of your management plan, you need to know how native plants are affected. Decreaser species, which are noted on the following pages, are most liked and sought after by livestock. Repeated overgrazing causes them to decrease in abundance and vigor. Increaser species are not as readily selected. Initially they increase in numbers following misuse of a prairie, then decline as abuse continues. Proper management will maintain the two groups in balance.



Native plants for dry to medium soil



Jim Rathert



Little bluestem *
Schizachyrium scoparium
2-4 feet tall



Jim Rathert



Sideoats grama *
Bouteloua curtipendula
1-2 feet tall



Jim Rathert

Prairie dropseed *
Sporobolus heterolepis
1.5-2 feet tall

Decreaser species *
Increaser species **



Don Kurz

Rough blazing star *
Liatris aspera
2-4 feet tall



Bill Hall

Purple prairie clover *
Dalea purpurea
1-3 feet tall



Jim Rathert

Prairie larkspur *
Delphinium carolinianum
3 feet tall



Don Kurz

Slender bush clover *
Lespedeza virginica
3 feet tall



Don Kurz

Smooth aster *
Aster laevis
2-3 feet tall



Kay Yaskievych

Gray-headed coneflower *
Ratibida pinnata
3-4 feet tall



Don Kurz

Pale purple coneflower *
Echinacea pallida
2-3 feet tall



Don Kurz

Showy goldenrod
Solidago speciosa
2-4 feet tall



Richard Thom

Prairie coreopsis *
Coreopsis palmata
1.5-2.5 tall

Missouri black-eyed Susan
Rudbeckia missouriensis
 1.5-3 feet tall

Jim Rathert



Blue sage *
Salvia azurea
 4-5 feet tall

Gary Reese



Don Kurz

Sensitive briar *
Schrankia nuttallii
 3 feet tall



Jim Rathert

Lead plant *
Amorpha canescens
 3 feet tall

Decreaser species *
 Increaser species **

Native plants for well-drained, deeper soil



Jim Rathert



Little bluestem *
Schizachyrium scoparium
2-4 feet tall



Jim Rathert



Big bluestem *
Andropogon gerardii
5-9 feet tall



Jim Rathert



Indian grass *
Sorghastrum nutans
5-7 feet tall



Ginny Wallace



Eastern gama grass *
Tripsacum dactyloides
5-8 feet tall



Jim Rathert

Butterfly weed **
Asclepias tuberosa
2-3 feet tall



Don Kurz

Wild indigo **
Baptisia alba
3-4 feet tall



Tim Smith

Roundheaded bush clover *
Lespedeza capitata
2.5-4 feet tall



Jim Rathert

Illinois bundleflower *
Desmanthus illinoensis
3-5 feet tall



Jim Rathert

Compass plant *
Silphium laciniatum
4-8 feet tall



David Catlin

Prairie blazing star *
Liatris pycnostachya
2-4 feet tall



Don Kurz

Rattlesnake master *
Eryngium yuccifolium
2-3 feet tall



Jim Rathert

New England aster *
Aster novae-angliae
3-5 feet tall

Decreaser species *
Increase species **

Native plants for moist, deep soil



Gimny Wallace



Eastern gama grass *
Tripsacum dactyloides
5-8 feet tall



Gary Reese

Prairie cordgrass or riggut *
Spartina pectinata
5-7 feet tall



Jim Rathert

Swamp milkweed
Asclepias incarnata
2-5 feet tall



Don Kurz

Culver's root *
Veronicastrum virginicum
3-5 feet tall



Jim Rathert

Ashy sunflower *
Helianthus mollis
3 feet tall



Don Kurz

Cup plant
Silphium perfoliatum
4-8 feet tall



Don Kurz

Sweet coneflower *
Rudbeckia subtomentosa
3-5 feet tall



Don Kurz

Willow aster *
Aster praealtus
5 feet tall

Exotic, Invasive Species



Jim Rathert

Reed canary grass



George Yatskievych

Tall fescue



Jim Rathert

Johnson grass



George Yatskievych

Autumn olive



Jim Rathert

Sericea lespedeza



Michael Jeffords

Multiflora rose



Don Kurz

Common teasel



Tim Smith

Purple loosestrife



David Bruns

Musk thistle

Initial Care of Native Plantings

The first few years are critical to establishing a new prairie planting. The biggest concern is controlling weeds, which are defined as plants—either native or exotic—that you do not want growing in your grassland. Species that compete with native grasses, such as early successional species that grow quickly and capture nitrogen, are important to keep in check. The method you use depends on the site and which unwanted plants are growing there.

Mowing

Mowing to control weeds is important the first and possibly the second and third years. Whenever weeds reach 12 inches tall during the first growing season, mow them to a height of 6 inches. If you cut lower than 6 inches, you may harm the native grasses that grow from a node on the stem, which is higher than that of most cool-season grasses. Maretail, common ragweed, heath aster and a few other early successional plants may need to be mowed in late May or early June the second year to prevent them from overtopping young grasses.

By mowing, you'll reduce competition for light and moisture. You'll also help keep unwanted plants from going to seed. Mowing is especially important in a dry year when moisture is limited. Mow frequently to avoid letting weeds get too tall. If you wait too long to mow, the clippings may smother your new plants.

Chemicals

Herbicides can help combat weeds, but do not use broad spectrum sprays that could harm your planting. Spot spraying local weed infestations with a selective herbicide is one way to control weeds in small fields. Another option is rope-wicking, which uses a recirculating sprayer mounted on a tractor to target taller weeds.

Burning

Prescribed fire will help to control many woody plants and cool-season grasses such as tall fescue. Prescribed burns initially should be done during late February through early April when most native species are still dormant. In the first year you may not have enough plant material to conduct a burn, but burning each year or two for the first five or six years after planting will favor prairie species. Fall burns favor forbs over grasses, so an occasional fall burn is recommended unless forage production is the goal.



ornate box turtle

Prairie Life

True prairies take many years to develop. If your efforts are successful, you can expect the number of native plant species to increase slowly as the conditions become right for more conservative species—the ones that would naturally develop later in succession. For example, if you start by planting 10 species on a medium-moist or mesic site, after careful management your plot would be considered successful if it had 50 plant species in 15 years and 75 species in 25 years. To increase the number of species in a shorter time, you could overseed or do spot plantings as the grassland develops.

The size and relative amount of open grassland to forested borders plays a big role in how well prairie wildlife species use the area. A long, narrow field, for instance, makes it easier for predators to find nesting birds. By the same token, neighboring landowners can increase the wildlife value of their lands by creating native grassland in adjoining fields, thus increasing the overall size of connecting grassland habitat.

Timing of burning, grazing and mowing also affects the kinds of birds and other wildlife that are attracted to your land. Some birds, such as the upland sandpiper, use shorter grasses while others, such as Henslow's sparrow, prefer taller, older growth. As your mix of grasses and forbs develops, you can begin to explore which species do best in your area and on your type of plants. Although an area of 100 acres isn't likely to attract more than a few species of nesting grassland songbirds, you can expect that grasshopper sparrows, quail, meadowlarks and dickcissels will successfully nest if not disturbed by mowing or haying during the nesting period.



Upland sandpiper

Managing Native Grasses and Forbs

Whether you've planted your own native grasses, grass and forb mix or started with native prairie, keeping your native grassland healthy and thriving all comes down to a few basic long-term management techniques.

Prescribed burning

In Missouri where we typically average 38 inches of annual rainfall, trees and shrubs invade grasslands. In the past, Native Americans played a role in keeping our grasslands open by purposely setting fires from time to time. Today, grazing and haying can provide useful controls, as well as generating forage or income. But for the greatest success with warm-season grasses and prairie forbs, you'll need to continue the early Americans' tradition by doing periodic burns, typically every two to three years.

Fire is great tool when used under the right conditions. It releases nutrients, controls ground litter and some unwanted plants, stimulates seed production and can help improve plant diversity, which in turn helps distribute grazing pressure. If you cannot safely burn in your area and want to enhance forbs and keep the nutrients on the land, mowing in the late fall or winter is the next best choice.

You can boost plant diversity by varying the burning season. Burns in late winter or late summer will favor forbs, cool-season grasses and woody plants, while April to May burns favor native warm-season grasses and do more to control cool-season grass and woody plants. To enhance the warm-season grasses, prescribed burns should be done when the new growth on bluestems is 1 inch high. The timing varies around the state, but usually occurs in early April in south Missouri and late April in north Missouri. Avoid burning in drought years or when winter and spring rains are below normal.

For optimum forage production for either grazing or haying, conduct burns in the spring only because fall or winter burning significantly reduces warm-

season grass production from 20 to 60 percent. To enhance prairie diversity, on the other hand, use prescribed burns occasionally in the fall or winter. This will improve forb density, help grassland wildlife and reduce grass dominance. Burning too often in the fall, however, may cause erosion problems and encourage invasion by cool-season grasses.

Safety features for controlled burning can be designed into your warm-season grass planting, using roads, closely mowed cool-season grasses, crop fields or other areas that will help to act as natural firebreaks. Barriers can be built into grazed warm-season pastures by mowing an 8- to 16-foot wide strip the year prior to burning, before cattle are removed from the pasture. The cattle will then graze the tender new growth—leaving less fuel the following spring.

Periodically burning a prairie under prescribed conditions not only helps plants, but wildlife, too, by:

- ✓ making nests harder for predators to find. To keep some nesting cover available, burn only part of the area in any one year, or burn when wind, humidity and fuel moisture produce a spotty burn.
- ✓ improving animal movement by removing heavy litter.
- ✓ providing some open ground for dusting areas.

Learn to burn safely

Anyone planning a burn should have the training to do it safely. Contact your local Conservation Department or Natural Resource Conservation Service office to learn about short courses and professional assistance to help you learn the safe way to conduct a prescribed burn. See pages 33 and 35 for information on locating these offices in your area.

The Department also has available for purchase the video, "How to Manage a Prescribed Burn." See page 33 for ordering information.

Haying

Haying is less effective than grazing or burning for maintaining plant diversity and supporting wildlife, but it can help control woody plants while providing quality hay. If you have a grassland with a mix of forbs and warm-season grasses, you should alternate haying and burning instead of haying every year. That not only helps wildlife, but also will favor a greater diversity of plants.

The most important factor you control is the harvest date. The timing affects yield, forage quality, stand composition and future production

of both plants and wildlife. Maximum yield and highest quality don't occur at the same time. You get the greatest amount of hay in August, but the best crude protein content and digestibility for cattle in early May. That's because as the growing season progresses, plants put more nutrients into their stem bases and roots.

Many nesting birds, however, don't complete hatching until late June, and others nest until mid-July. The best compromise for forage quality and quantity and wildlife benefits is to hay in late June to mid-July. Repeatedly cutting native warm-season grasses after late-July can eventually reduce the following year's growth by as much as 50 percent.

Waiting until August or September to cut hay changes stand composition. Warm-season grasses are weakened by late cuttings, while some forbs increase. If your goal is to support wildlife and increase forbs, then later cutting can be a way to reduce warm-season grass density. Keep in mind, though, that late-cut prairies do worse in drought years than early-cut prairies.

Some of the adverse effects of late cutting can be modified by increasing cutting height. In any case, don't try to make up for lost production by fertilizing with nitrogen or by overseeding with cool-season grasses or legumes, such as red clover. Your native plants will suffer in the competition; and if you have a true prairie remnant, you'll destroy it.

Native grasses should not be cut closer than 4 inches to allow for rapid regrowth. Avoid grazing the regrowth or taking a second cutting—both of which reduce the vigor of the plants, weaken the stand, and eliminate important winter cover and spring nesting cover for wildlife.

Studies have shown that warm-season grasses are efficient at getting nutrients from the soil, but they use lots of phosphorous and potash. If hay is removed, these elements should be replaced. In any case, warm-season grasses don't need as much fertility added as cool-season grasses.

Though nitrogen might increase the yield of a



Indian grass

Livestock, as well as wildlife, can benefit when native grasses and forbs are used in pastures.



healthy stand of big bluestem and Indian grass in the short run, it will help cool-season grasses and weeds even more. If you use nitrogen, conduct a late spring burn to suppress the cool-season plants before you fertilize. Wait until the warm-season grasses are 4 to 6 inches high around mid-May, then apply 30 to 40 pounds of nitrogen per acre. Don't confuse early growing sedges and cool-season grasses with the later warm-season grasses when you figure the height.

The economics of fertilizing native hay prairies depend on the value of the increased hay produced—1/2 to 1 ton per acre—and the cost of fertilizer and applying it. Do not try to restore a poorly managed prairie with fertilizer, and do not fertilize unless you plan to burn.

An excellent practice is to rotate haying so part of the field rests each year. The rested part will often produce up to a ton more forage per acre the following year. The previous year's growth usually settles below the 4-inch cutting height by early July, so that little old growth is picked up in the new hay. This technique is especially good for restoring mismanaged prairies, and it gives wildlife more useful habitat.

Grazing

Landowners raising livestock are discovering the value of native grasses in a rotational mix. Livestock, landowners and wildlife can all benefit from grasses such as native bluestems, eastern gama grass and Indian grasses and the native forbs that traditionally grew with them. In fact, livestock will eat more warm-season grass than cool-season grass by choice.

When the soil reaches about 60 degrees F in the spring, warm-season grasses begin growing. Their peak growth occurs when the soil is 90 degrees F. Season production of warm-season grasses is comparable to that of cool-season grasses averaging 1.75 to 5 tons per acre, depending on soil, site and species mix. More than 70 percent of this tonnage is produced after May 15.

Crude protein levels of native-grasses are about 15 percent early in the growing season. By late August, protein will have declined to 6 percent. Pasture trials of yearling steers on mixtures of warm-season grasses ranged from 1.7 pounds per head per day in south Missouri to 2.8 pounds in north Missouri.

Guidelines for rotation grazing cool-season grass pastures

Livestock class	Pasture type	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Steer	Cool-season												
	Warm-season (mixed stand)*												
Cow-calf	Cool-season												
	Warm-season												

* 1. Early intensive grazing season (double-stocking rate)
2. Standard grazing season

Adding warm-season pasture to a cool-season pasture rotation system will improve efficiency. By fully using each type of forage during its prime growing season, you can provide better nutrition for your herd throughout the year. An added benefit of this complimentary forage system is that each type of grass has a rest period to strengthen its root systems, so the pastures continue to remain more productive and resilient in the long run. Nesting birds get a break because warm-season grasses provide adequate cover while being grazed, and grazed native warm-season grasses and forbs provide excellent brood cover. See guidelines chart above for the best dates for grazing warm- and cool-season grasses.

In general, the amount of warm-season pasture should be one-fourth to one-third of total grazed acres. The native warm-season grasses should be grazed no lower than 8 inches. On warm-season pastures where two or more units are available, one way to enhance the growth is by burning in the spring the first unit to be grazed that year.

Poor production of warm-season grass is usually a result of grazing or mowing too short or too late in the season. Native grasses need leaf surface to capture enough of the sun's energy to continue

growing above, as well as below, the ground. Although fescue often survives repeated close grazing, this practice severely weakens native warm-season grasses.

Estimating forage yield and rates

Proper grazing rates are extremely important for good weight gains and maintaining a healthy grass stand. You've reached the right stocking rate when the native warm-season grass stubble at frost is 12 to 15 inches tall. Generally, 8 inches of stubble on Sept. 1 will regrow to 12 inches by Nov. 1.

Estimate total forage yield based on soil types and density of the grass stand. Keep in mind that 4,000 pounds per acre is a statewide average that includes some deep north Missouri soils that produce 6,000 pounds per acre and some shallow Ozark soils that produce 2,000 pounds per acre. For help in determining forage production for managing warm-season pasture, contact the Conservation Department's private land conservationist or your local Natural Resources Conservation Service office. See pages 33 and 35.

Once you estimate the amount of forage available, you can fine tune your grazing rates

based on the specific needs of your livestock. See the forage consumption chart below to determine the average amount of forage needed for different classes of livestock.

This is only a general guide. Applying these average numbers to your site and herd is where the art of grassland management begins. It pays to be conservative with your initial stocking rates until you understand your grass and soil productivity.

Using rotational grazing to improve wildlife habitat

Whether you have a small or large prairie planting or remnant, you can use rotational grazing to improve the wildlife habitat value of your grassland. Although water for livestock may be an obstacle, fencing doesn't have to be. Single or double strand electric wire fences can be erected easily and cheaply.

If you have only one small planting or prairie remnant and no cattle of your own, you can still benefit from grazing by leasing to a neighbor for

one to seven days, once or twice during the late spring and summer.

The purpose of grazing is to break up the cover for better wildlife movement, reduce exotic grass and legume competition and, in some cases, reduce native warm-season grass dominance over native forbs. Do not leave the livestock in the field too long because they may weaken the native grasses and forbs. If livestock has grazed for too long, the damage can be reduced if the area is rested the next season or two, or grazed at an entirely different time of year.

Large plantings or prairies can be divided into several paddocks so that the animals can be moved every few days during the growing season, allowing a minimum of 40 to 45 days rest before they return.

Season-long rotation grazing

To mimic native grazers, allow livestock to graze on an area for an entire growing season, then rest the pasture for two to three growing seasons. Because native warm-season grasses store more carbohydrates in their roots when left ungrazed or unhayed, it is theorized that they can fully rebuild their root carbohydrates during two or three growing seasons when they are not grazed, even though they have been continuously and heavily used the season before. The advantage of continuous grazing is that it puts equal pressure on less palatable and palatable species, including grazing-sensitive native forbs.

To keep the pasture productive, either burn one-third to one-fourth of it each year or divide the pasture into thirds or fourths with fencing. Native grazers, such as bison and elk, and domestic livestock will seek the fresh new growth of burned areas and will continuously graze there until another freshly burned area produces new, succulent growth. Historically, these burns took place later in the growing season or during the dormant season and were often started by lightning.

Forage Consumption in Animal Units		
Livestock	Size	Animal units
Cattle	mature cow	1.00
	cow & calf	1.25
	weaning calf	0.50
	yearling (9-18 months) . . .	0.70
	mature bull	1.50
Horse	all	1.20
Mule	all	1.20
Sheep	ewe & lamb	0.30
	all others	0.20
<i>One animal unit equals one mature 1,000-pound cow, without calf. An animal unit day is the amount of forage an animal unit eats in one day (about 33 pounds dry weight).</i>		

Improving Cool-season Grassland for Wildlife

Even if you're not ready to add warm-season grasses, you can still improve the wildlife value of a pasture that's made up of only one or two cool-season grasses. Although the grass could be timothy, bluegrass, smooth brome grass or orchard grass, tall fescue is the most common pasture grass in Missouri today. If you don't manage fescue, it will form a dense sod with deep litter that hinders movement of wildlife, limits growth of other plants and provides few useful nutrients.

You'll help wildlife by creating a habitat that is diverse in types of plants, as well as in height. If your focus is seed production, you'll likely plant any one field to a single type, but you can still add diversity among fields. Ideally, forbs should make up 30 to 50 percent of the plant cover, with legumes making up half of the forbs.

If you're interested in enhancing your wildlife habitat in a field of fescue, your best options are:

- ✓ creating some diversity in the field by managing so that early successional plants invade
- ✓ replacing the fescue with a more wildlife-friendly mixture, such as timothy and clover or native warm-season grasses and forbs.

Disking

If you don't depend on the field for hay or forage, light disking is a good way to decrease the denseness of cool-season grasses and increase annual forbs. The bare soil created allows annual plants to become established and produce seed. Wildlife will benefit from the annual forb seeds and insects that feed on the forbs. Disking should be 2 to 4 inches deep and occur between Oct. 1 and April 30. To reduce the amount of cool-season grass, disking is most effective in late spring when the grass is growing and the root reserves are low. To get more annual forbs to grow, disk in the fall.

If you disk a different third of the field each year, you'll create an ever-changing mix of plants at little cost. Be sure, however, to keep an eye on

the plants so you can control the ones that later could become serious problems. Ragweed, a good wildlife food plant, is one of the early successional plants that will invade first, but it will naturally be replaced by another plant species. Sericea lespedeza, on the other hand, would become a real problem if you let it go to seed.

Overseeding with legumes

Legumes, such as clovers and lespedezas, remove nitrogen from the air and add it to the soil, where it's available for other plants. Adding legumes to a cool-season grass mix will improve livestock performance, while providing some food for wildlife. Having a good mix and an adequate stand of legumes can provide up to an average of 30 percent of cool-season grass nitrogen needs and all of the nitrogen needs for warm-season grasses.



Quail benefit from native warm-season grasses because they attract the insects the birds need to eat. The grasses aren't as thick as fescue, which allows the chicks to expend less energy as they follow their mother while hunting for food.

Eradicate sericea lespedeza

It's important to note that one non-native type of legume, sericea lespedeza, is extremely invasive and therefore harmful. If you find it on your land, you should try to spot spray or mow it before it goes to seed. Sericea grows in dense colonies, and individual plants are often multi-branched. Sericea flowers are white and scattered through the crown. See page 22.

Native slender lespedeza grows on individual stems that are rarely branched, and its pink to lavender flowers are densely clustered. Another native plant, violet lespedeza, has flowers that are lavender to purple.

Other types of legumes that can crowd out native species include birdsfoot trefoil, crown vetch and yellow sweet clover.

An ideal mix of legumes to grasses would be 1:3. Keeping the legumes in the mix, though, requires careful grazing and occasional overseeding. Native legumes such as bundleflower, tick clover and prairie clover and non-natives such as alfalfa and annual lespedeza work better with warm-season grasses. For cool-season grasses use non-natives such as alfalfa, ladino clover, alsike clover, red clover and annual lespedeza. Purchase certified seed to get the best type for your soil and climate.

Overseed by broadcasting in winter because the freezing and thawing of the soil will work the seeds into the ground. Before overseeding, open the mat of cool-season grass by close grazing or mowing, or by burning in the summer, fall or winter. This reduces litter and allows better seed and soil contact. The seeding rate should be based on pure live seed, the percentage of seed that will germinate from the batch you're planting. Legume seeds should be inoculated with the *Rhizobium* bacteria less than 12 hours before planting. Most alfalfa and clover seed sold today is preinoculated and should be seeded before the expiration date. The inoculant is important because it helps form nitrogen-fixing root nodules on the plants, which will help the legumes add nitrogen to the soil.

Broadcast seed rates should be 25 percent higher than drilled seeds because good soil contact is more random. In addition, when overseeding a pasture by broadcasting, seeding rates should be

higher than on bare soil. Ten percent survival is typical. Use a culti-packer to increase soil contact. Livestock may be used to improve seed-to-soil contact, but should be removed from new seedings until the plants are well established.

Grazing

Grazing is a cost-effective tool to increase wildlife habitat in a cool-season pasture. Light stocking in which some of the pasture is closely grazed and some is virtually untouched, usually creates the most usable wildlife habitat. It is not necessarily the most efficient use of the pasture for livestock, but it is an option if your primary objective is wildlife.

Livestock are selective about the plants they eat. Continuous heavy stocking weakens grasses and legumes because livestock tend to repeatedly graze some plants and leave others.

Rotational grazing, when livestock is moved to give a pasture or part of a pasture a chance to rest, is a better grazing method that also can benefit wildlife. It allows you to use the grasses at their peak production, protein content and palatability. It helps the growth of legumes, such as clovers, and allows wildlife nests to survive when the rotation period isn't too short. It increases the number of high-quality plants per acre, which increases livestock production, improves wildlife food and

cover, and conserves water. Most rotational systems work best if you have some native warm-season grass pastures to provide productive forage when the cool-season grasses are dormant. Rest these native warm-season grasses in late summer and fall to replenish root reserves.

With fescue, intensive grazing is useful in early spring. Keep the grass below 3 inches until the peak growth is over, which occurs around mid- to late May. This will create patches of bare ground, which in turn will allow summer forbs such as ragweed to grow. Light grazing of part of the field in late fall or early spring can help create paths for wildlife to move through the dense fescue.

Haying

Other than getting rid of litter and controlling woody invaders, haying is less useful to enhance your grassland and the wildlife it supports. If you want to hay, though, the timing and height of mowing are important. Cutting too early may reduce not only grass, but also nesting wildlife production. Cutting too late will weaken the stand by keeping grasses from replenishing their root reserves before winter. Late cuttings also limit regrowth and, thus, reduce winter cover for wildlife. This lack of cover means not only less shelter from the elements, but also less shelter from predators.

Cutting part of the hay field at different times of the year will increase habitat diversity for wildlife. Timothy and smooth brome grass are better for wildlife than tall fescue and orchard grass because you can cut the hay in early July, giving birds time to finish nesting.

Cutting grasses too low will remove the point, or node, on the grass stem where new growth occurs. Regrowth of the grass will be slower because the growth point has been removed and the new leaves will have to grow from the dormant buds lower on the stem. To keep cool-season grasses, except fescue, thriving, cut the grass at a height of about 4 inches.

Prescribed burns

Prescribed burning is a good method for keeping warm-season grasses healthy, but is less useful for cool-season grasses. However, if you burn in early spring before fescue or other cool-season grass growth exceeds 1 inch or during summer dormancy, you'll stimulate the grass and remove litter. The cool-season grasses will be set back the first year, but will be improved the second year because plant residue was removed.

Woody invasion can be slowed with April through May burns when woody plants are fully leafed out and root reserves are low, but that's also when cool-season grasses can be harmed. If you intend to overseed with a legume, though, burning some areas may create open ground.

If you're trying to convert from fescue, combining an early spring burn with an herbicide application when the fescue is 8 inches tall will give it a one-two punch. For a late winter or spring planting, a mid- to late-summer burn timed to allow regrowth, followed by spraying the regrowth before the fescue goes dormant, is ideal.

Applying herbicide to fescue in the fall is significantly more effective and results in a better kill of established plants than when treated in the spring. However, you can expect considerable regeneration from seed if the field is not cropped for at least one year or if additional herbicides are not applied.

Prescribed burns, of course, should be conducted only when the wind is low and within prescribed limits, and the soil is moist to protect roots and crowns. Use trained, qualified people who follow a burn plan and local statutes. Contact your local Conservation Department private land conservationist or Natural Resource Conservation Service office for more information. See pages 25, 33 and 35 for more information.

Contacts

For help developing your grasslands, contact the following experts. You can also visit the Conservation Department's website at: www.mdc.mo.gov.

Missouri Department of Conservation

Private land conservationists can provide advice on a wide variety of land management objectives, including prairie restoration, stream bank stabilization, hay and grazing systems, livestock watering systems and soil erosion control. At the landowners request, they also can make recommendations on pond, forest, wildlife and natural community management, and can help with wildlife that are a nuisance or causing property damage. These private land conservationists, who have special training in one discipline, call on other Conservation Department, Natural Resource Conservation Service, and University of Missouri Outreach and Extension specialists as the need arises.

Private land conservationists meet with landowners one-on-one, hold workshops and give presentations to farmers' organizations, civic clubs and conservation organizations. They also provide technical support to agricultural education instructors on wildlife projects. See page 35 for the number to call in your area.

To request free publications, contact:
Missouri Department of Conservation
P.O. Box 180
Jefferson City, MO 65102-0180
Phone: 573/751-4115, ext. 3851

For a free list of nurseries that carry native seed adapted to Missouri, write to Private Land Services at the above address.

To purchase Department videos and other gift shop items, call the Nature Shop at 877-521-8632 from 8 a.m. to 5 p.m. CST, Monday through Friday except holidays. The Nature Shop number is for purchases only. If you have a question about conservation issues, call a number on page 35.

Natural Resources Conservation Service

The Natural Resources Conservation Service, or NRCS, is a unit of the U.S. Department of Agriculture. NRCS is responsible for the technical aspects of USDA programs, and works closely with the Farm Service Agency in the administration of these programs.

Local NRCS personnel can assist in developing conservation plans that detail the practices necessary to protect your land from erosion, improve water quality and create better fish and wildlife habitat. They also make forage and crop management recommendations, help with the design of terraces, waterways and ponds, and suggest plant species that best meet your resource needs.

Your local NRCS office is listed in the telephone book white pages under "United States Government—Agriculture, Department of—Natural Resources Conservation Service."

University Outreach and Extension

University Outreach and Extension, formerly called Missouri Cooperative Extension Service, provides technical assistance on a broad range of agricultural projects. These offices have a wide selection of printed material available on various aspects of agriculture, forestry, horticulture, home economics, wildlife conservation and wildlife damage to property and crops. Your University Outreach and Extension office also will do soil testing and help you interpret the results.

University Outreach and Extension has agricultural advisors stationed at many locations throughout the state. They work individually with farmers or give presentations to groups on agricultural topics.

Your county office is listed in the yellow pages under "Government Offices—County." It often is listed as "University Outreach and Extension, University of Missouri."

Soil & Water Conservation District

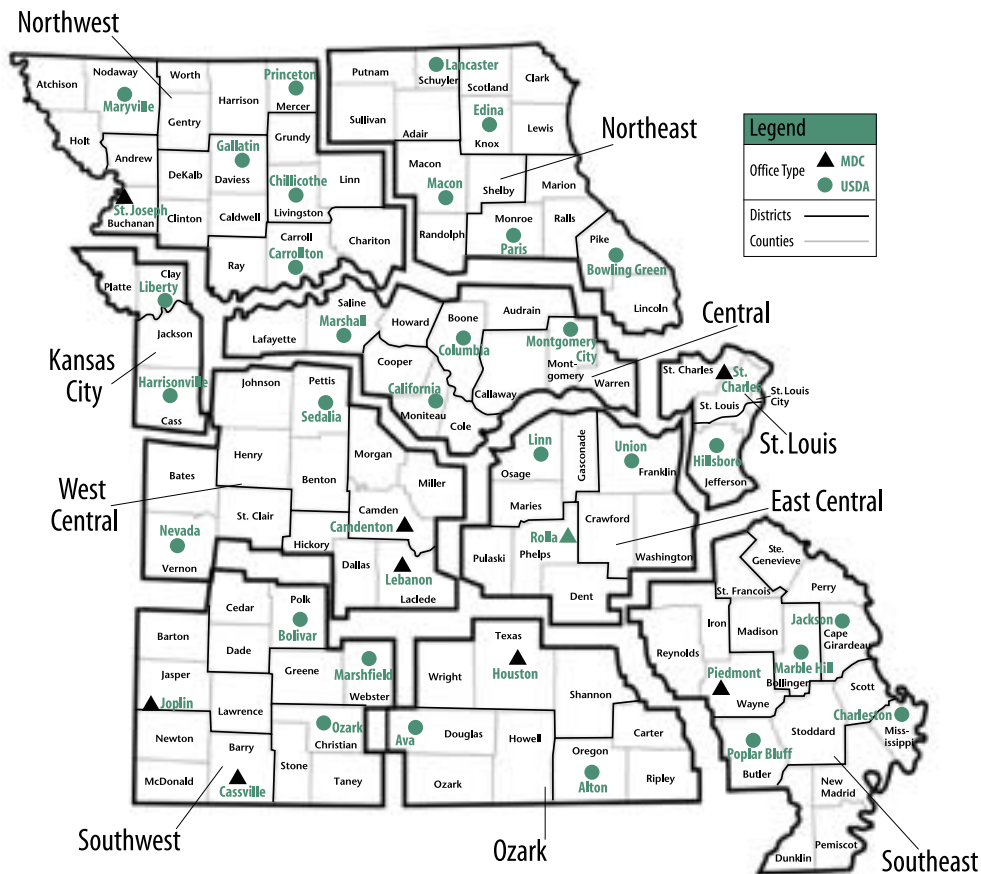
The Soil and Water Conservation District, or SWCD, is a local organization under the Soil and Water District Commission of the Missouri Department of Natural Resources. Each district is guided by an elected volunteer board of directors, made up of local landowners. Local district boards usually employ a manager and one or more technicians who assist the Natural Resources Conservation Service field staff.

The districts administer state cost-share conservation programs with assistance from the Department of Natural Resources and NRCS. In conjunction with NRCS, SWCD supports various resource conservation activities; and in many districts, the agency provides conservation education to local schools. Many SWCD offices also participate in cooperative cost-share programs with the Missouri Department of Conservation. Your local SWCD office will usually have the same telephone number as the NRCS office.

Reference books

- ✓ *Missouri Wildflowers* by Edgar Denison *
- ✓ *Steyermark's Flora of Missouri, Vol. I*, by George Yatskievych *
- ✓ *Tall Grass Prairie Wildflowers* by Doug Ladd
- ✓ *Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands* edited by Stephen Packard and Cornelia F. Mutel
- ✓ *The Prairie Garden* by J. Robert Smith with Beatrice S. Smith
- ✓ *Restoring the Tallgrass Prairie* by Shirley Shirley

* Can be purchased from the Missouri Department of Conservation. See page 33.



The Conservation Department's Private Land Services staff is available to help you develop and manage grasslands on your property. For the name of a contact person, call the Conservation Department or USDA office in your district, which are listed below. On the internet, go to Private Land Assistance on the Missouri Department of Conservation web site: www.mdc.mo.gov

▲ Administrative Office

Jefferson City: 573/751-4115

Northwest

- ▲ St. Joseph: 816/364-3662
- Carrollton: 660/542-3361
- Chillicothe: 660/646-5687
- Gallatin: 660/663-3703
- Maryville: 660/582-7125
- Princeton: 660/748-3857

Northeast

- Bowling Green: 573/324-3201
- Edina: 660/397-2223
- Lancaster: 660/457-3716
- Macon: 660/385-2149
- Paris: 660/327-4117

Kansas City

- Liberty: 816/781-5580
- Harrisonville: 816/884-3391

Central

- California: 573/796-2010
- Columbia: 573/446-9091
- Marshall: 660/886-5773
- Montgomery City: 573/564-3715

St. Louis

- ▲ St. Charles: 636/441-4554
- Hillsboro: 636/789-2441

West Central

- ▲ Camdenton: 573/346-2210
- ▲ Lebanon: 417/532-7612
- Nevada: 417/667-8137
- Sedalia: 660/826-3354

East Central

- ▲ Rolla: 573/368-2225
- Linn: 573/897-3797
- Union: 636/583-2303

Southwest

- ▲ Cassville: 417/847-5949
- ▲ Joplin: 417/782-8313
- Bolivar: 417/326-5993
- Marshfield: 417/468-4176
- Ozark: 417/581-2719

Ozark

- ▲ Houston: 417/967-3385
- Alton: 417/778-6610
- Ava: 417/683-4816

Southeast

- ▲ Piedmont: 573/223-4525
- Charleston: 573/649-9930
- Jackson: 573/243-1467
- Marble Hill: 573/238-2671
- Poplar Bluff: 573/785-6160

Local Resources



Scissor-tailed flycatcher

When you look up the name and number of a local resource person in your telephone directory, make a note below for later use.

Private Land Conservationist _____

Phone No. _____

Conservation Agent _____

Phone No. _____

Wildlife Management Biologist _____

Phone No. _____

Fisheries Management Biologist _____

Phone No. _____

Regional Naturalist _____

Phone No. _____

Resource Forester _____

Phone No. _____

Other Conservation Department resource _____

Phone No. _____

Soil & Water Conservation District _____

Phone No. _____

Natural Resources Conservation Service _____

Phone No. _____

University Outreach & Extension _____

Phone No. _____

Other Agency _____

Phone No. _____

Local Fire Department _____

Phone No. _____



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